RESEARCH PROTOCOL

First Falsifiable Prediction of Relational Ontology

Vector consciousness (s,i,r) vs. scalar phi (IIT Tononi) — a testable structural difference

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The Self-Experiencing Universe: A Manifesto for an Emergent Reality (Lis, 2025)

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PROTOCOL SUMMARY

This protocol formulates the first falsifiable empirical prediction of Relational Ontology (Lis, 2025). The prediction follows directly from the HoTT-RO v2 formalization: consciousness is a vector (s, i, r) in topological space, not a scalar phi — which leads to a concrete, distinguishable difference between relational ontology and Integrated Information Theory (IIT, Tononi).

Prediction: two biological systems with comparable integrated information (phi) but different (s, i, r) vector profiles should exhibit qualitatively different behavioral patterns — not explainable by phi alone. IIT does not predict this difference. Relational ontology predicts it as a necessary structural consequence.

Test systems: honeybee swarm vs. Sepia officinalis — selected for comparable estimated phi with radically different (s, i, r) vectors.

Part I — The Formal Prediction

1.1 The prediction in one sentence

P1 — Vector Consciousness Prediction (VCP):

Two biological systems A and B for which phi(A) ≈ phi(B), but whose vectors (s, i, r) are structurally different — **exhibit qualitatively different patterns of behavioral adaptation** in response to the same environmental stimuli, not explainable by phi alone.

1.2 IIT vs. Relational Ontology — the distinguishing difference

	IIT (Tononi)	Relational Ontology / HoTT-RO v2
Measure of consciousness	phi — one scalar	vector (s,i,r) — three dimensions
Two systems, phi(A)≈phi(B)	Same level, similar behavioral patterns	Different forms, qualitatively different patterns
Form of consciousness	Concept absent from the theory	Central construct — vector (s,i,r)
Falsifiable prediction	phi sufficient to explain behavioral patterns	phi insufficient; vector (s,i,r) necessary

1.3 Formal statement in HoTT-RO v2

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Let A, B : RelConfig such that:
  phi(A) ≈ phi(B)                          [IIT-equality condition]
  ConsciousnessForm(A) ≠ ConsciousnessForm(B)  [vector-difference
condition]

Where ConsciousnessForm(κ) :≡ (Stability(κ), Integration(κ),
Recursion(κ))

VCP asserts:
  ∃ BehavioralSignature : RelConfig → BehType
  such that BehavioralSignature(A) ≠ BehavioralSignature(B)
  and BehavioralSignature is not a function of phi
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Part II — Test Systems

System A: Honeybee swarm — predicted vector (s≈0.62, i≈0.90, r≈0.37)

High integration (i): no bee decides alone about nest location; the decision emerges from the waggle dance quorum; the system cannot be decomposed without losing its decision capacity.

Low recursion (r): the swarm does not model itself; there is no self-referential entity — bees respond to signals, not to a representation of the whole's state.

System B: Cuttlefish (Sepia officinalis) — predicted vector (s≈0.57, i≈0.80, r≈0.85)

High recursion (r): the cuttlefish demonstrates observational learning, problem-solving through trial and error, strategy change after failure, and REM-like sleep suggesting auto-simulation.

Moderate integration (i): distributed nervous system (2/3 of neurons in arms), coordinated by a central brain lobe — integrated but less centralized than the swarm.

Part III — Predicted Behavioral Differences

Category	Swarm prediction (high i, low r)	Cuttlefish prediction (high r, mod. i)
Adaptation to new environment	Slow, collective, through quorum of signals — explores through many agents simultaneously	Fast, individual, through trial-and-error — tests strategies sequentially and modifies on the fly
Response to failure	Redistribution of activity in network — bees take over function; no 'strategy' change as a whole	Strategy change by subject — cuttlefish tries differently after failure; clear individual learning
Recognition of new threat	Slow but scalable — detection by signal aggregation; sensitive to population-level threats	Fast but local — immediate reactivity; real-time camouflage adjustment
Multi-step adaptation task	Slow, proportional to signal dispersion; no shortcut through individual reasoning	Fast, individual; sequential trials; real-time rule modeling

Part IV — Falsification Conditions

When VCP is false

1. VCP is false if behavioral patterns of the swarm and the cuttlefish are qualitatively similar despite different (s,i,r) vectors — demonstrated in a well-designed experiment satisfying conditions α and β.
2. phi(A) turns out to be substantially different from phi(B) — which would violate condition α and invalidate the comparison.

3. The vector (s,i,r) proves non-functional — two configurations with identical vectors exhibit different behaviors in the same environment.

When VCP is confirmed

4. Systems with comparable phi but different (s,i,r) vectors exhibit qualitatively different behavioral patterns in two or more independent experiments.
5. The pattern of differences is consistent with the predictions: high integration (i) correlates with collective adaptation, high recursion (r) correlates with individual adaptation.
6. Results are not explainable by phi alone or by other confounding variables.

Open Gap — The phi Condition

The one remaining technical gap: phi is not standardly measured for collective systems (swarms). The comparability phi(swarm) ≈ phi(cuttlefish) is an assumption requiring empirical verification. This is a technical, not a conceptual limitation.

Direct question to IIT researchers: is phi operationally measurable for a spatially distributed collective system such as a honeybee swarm? If yes — one measurement closes this gap and VCP becomes fully testable.

References

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